

REMARKS

By the present Amendment, claims 10, 18, 22, 30, 34 and 42 are amended. Claims 13, 17, 25, 29, 37 and 41 are cancelled and claims 46-51 are added. This leaves claims 10, 14, 16, 18, 20-22, 26, 28, 30, 32-34, 38, 40, 42 and 44-51 pending in the application, with claims 10, 22 and 34 being independent.

Rejections under 35 U.S.C. §102 and §103

Each of the presently pending independent claims, claims 10, 22 and 34, recite a process for producing adhesion elements on a substrate. The process comprises steps of introducing thixotropic plastic material of polyvinyl siloxane into mold cavities in at least one shaping element. Each of the mold cavities has a circumferential boundary wall extending in a lengthwise direction thereof continuously along a convex path. Each convex path has a curvature with increased radii of curvature adjacent an inner end and decreased radii of curvature adjacent an outer end. The plastic material is formed into at least 16,000 adhesion elements with flared ends per cm² accomplishing adhesion predominantly by van-der-Waals forces. The flared ends are formed at the inner ends of the mold cavities, with the flared ends forming heads. The adhesion elements have stem parts with ends being formed at the outer ends of the mold cavities and being opposite the flared ends, with a height from 50 µm to 150 µm and with a diameter from 10 µm to 40 µm. The flared ends have a diameter from 15 µm to 70 µm. Claim 10 further recites that the heads are formed with essentially flat end surfaces. Claim 22 further recites that the heads are formed with slightly convex end surfaces. Claim 34 further recites that the heads are formed with end surfaces having a concavity.

By performing the process in this manner, the adhesion elements are formed so as to adhere to other surfaces as a result predominantly of van-der-Waals forces, not by interlocking with mating adhesion elements in the nature of a hook-and-loop type fastener, also called a “Velcro” fastener. Such predominant adhesion by van-der-Waals forces is achieved without the defibrillation of adhesion stems formed according to a biomedical model based on a geckos foot, and is made possible with the particular plastic material, shape, density and dimensions of the adhesion elements recited in claims 10, 22 and 34.

Claims 10, 13, 16-18, 20, 22, 25, 28-30, 32, 34, 37, 40-42 and 44 stand rejected under 35 U.S.C. §103 as being unpatentable over WO Publication WO 03/099951 to Arzt in view of U.S. Patent Publication No. 2006/0005362 to Fearing. U.S. Patent Publication 2006/0005362 is used as a translation of the Arzt International publication. The Arzt publication is cited for a process for producing adhesion elements on a substrate using polyvinyl siloxane, a packing density of 10^6 to 10^7 per cm^2 , projection elements having a height from 20000 nm to 200 micrometers and a diameter of 20 nanometers to 20 micrometers, an end at at least 20 micrometers and flared ends that can be shaped. Relative to the viscosity, the stiffness of the microstructures in the Fearing publication is cited, and allegedly it would be obvious to adjust the viscosity of the adhesion element to create a molding material that is stiff or flexible. Similarly, relative to the claimed shear rate, the Fearing stiffness is again referenced and the selection of the claimed shear rate is alleged to be mere optimization of a known result effect of a variable relative to claims 13, 25 and 37. The Arzt publication is alleged to teach the shapes of claims 16, 28 and 40. Relative to claims 17-18, 29-30 and 41-42, the Arzt publication is alleged to teach a contact angle that is greater than 70 degrees. Relative to claims 20, 32 and 44, the Arzt publication is cited as

teaching a height of up to 200 micrometers. Relative to the adhesion elements having a diameter of 30 micrometers and a flared end of approximately 50 micrometers, such features are allegedly obvious in view of the Fearing teaching of optimizing the size, stiffness and adhesive force of the adhesive elements.

Claims 14, 26 and 38 stand rejected under 35 U.S.C. §103 as being unpatentable over Arzt International publication and the Fearing U.S. publication in view of U.S. Patent Publication No. 2005/0072509 to Full. The Full publication is cited for teaching the use of an imprinting roller. In view of this teaching, it is alleged that it would be obvious to use a nano-imprinting roller in the Arzt process as modified in view of the Fearing publication.

Claims 21, 33 and 45 stand rejected under 35 U.S.C. §103 as being unpatentable over Arzt International publication and the Fearing U.S. publication when further considered in view of U.S. Patent No. 7,018,496 to George. The George patent is cited for use of thermosetting compositions mixed with thermoplastic compositions and crosslinked to form adhesion elements. In support of the rejection, it is alleged to be obvious to use the George compositions in the Arzt system.

The three independent claims are patentably distinguishable over the cited patent documents by (1) the use of thixotropic polyvinyl siloxane to form the adhesion elements, (2) the density of 16,000 elements per cm^2 , (3) the claimed dimensions of the adhesion elements and (4) the shape provided by the different radii of curvature of the mold cavity boundary walls, particularly in combination. Such features are not disclosed or rendered obvious by the cited documents.

Relative to the recitation of “polyvinyl siloxane”, Arzt U.S. publication paragraph 103 is cited. However, this paragraph does not specifically disclose a thixotropic polyvinyl siloxane as claimed.

The claimed curvature shape is not disclosed or rendered obvious by the cited publications. This claimed curvature shape, disclosed in connection with Fig. 2, permits creating small lip head parts necessary to achieve high Van-der-Waals forces for adhesion purposes. This claimed unique combination of shape materials, density and dimensions has been found to be particularly effective for adhesion elements accomplishing adhesion by van-der-Waals forces. Additionally, the claimed features cannot properly be found obvious based on a combination of the cited publications.

Accordingly, claims 10, 22 and 34 are allowable.

Claims 14, 16, 18, 20-21 and 46-47, claims 26, 28, 30, 32-33 and 48-49 and claims 38, 40, 42, 44-45 and 50-51, being dependent upon claims 10, 22 and 34, respectively, are also allowable for the above reasons. Moreover, these dependent claims recite additional features further distinguishing them over the cited patents.

Claims 14, 26 and 38 are further distinguishable by the screen having at least 16,000 mold cavities per cm².

Claims 16, 28 and 40 are further distinguishable by their hyperboloid shape, which is not shown to be obvious in connection with adhesion elements accomplishing adhesion predominately by van-der-Waals production in Fig. 7 of the Arzt publication.

Claims 20, 32 and 44 are further distinguishable by the specific dimensions of the head adhesion elements so as to provide adhesion predominantly by van-der-Waals forces.

Claims 21, 33 and 45 are further distinguishable by crosslinking of the plastic material. Crosslinking of the plastic material for adhesion elements accomplishing adhesion predominately by van-der-Waals forces is not rendered obvious by the George patent since it does not use polyvinyl siloxane.

Claims 47-51 are further distinguishable by the locations of the different curvature portions along the lengths of the mold cavities.

In view of the foregoing, the presently pending claims are allowable. Prompt and favorable action is solicited.

Respectfully submitted,



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